

JAPANESE

[JP,09-162147,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

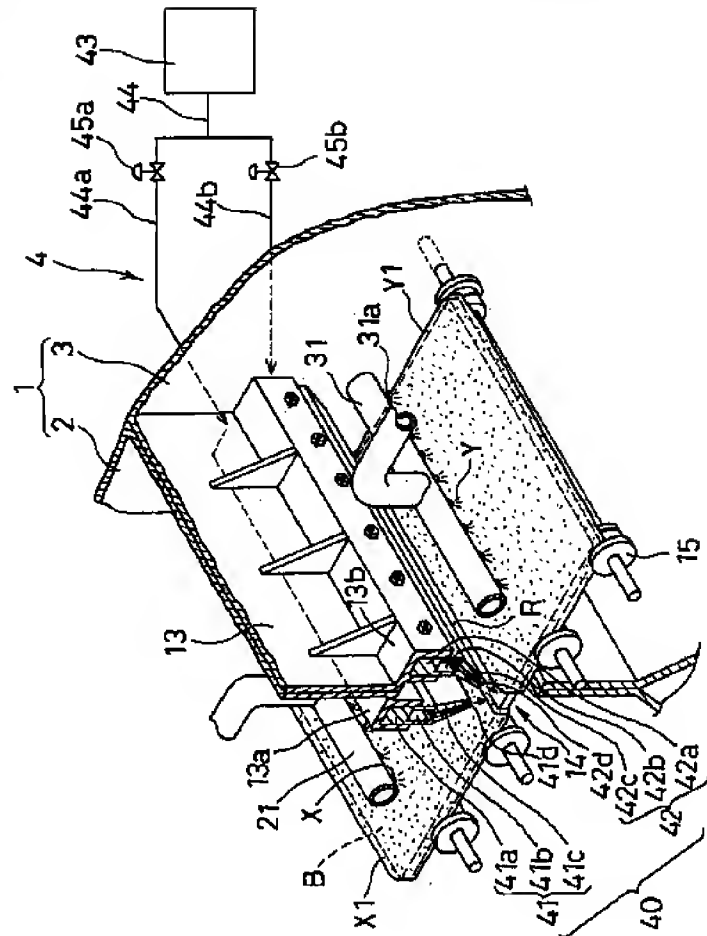
[Field of the Invention]This invention relates to the substrate processing device with which it comes to form successively two or more processing tubs which supply a treating solution to the substrate conveyed to an abbreviated horizontal direction.

[0002]

[Description of the Prior Art]As for substrates, such as a liquid crystal and a semiconductor, predetermined processing is performed, when it is conveyed in order by an abbreviated horizontal position and various kinds of treating solutions are supplied by the transportation means of a conveyor belt, a roller, etc. within each processing tub in the processing tub by which two or more processing tubs were formed successively. The treating solution in which the liquid in which descriptions, such as a developing solution, a penetrant remover, an etching reagent, release liquid, and pure water, differ was used, for example, and the above-

Drawing selection

Representative draw



[Translation done.]

mentioned treating solutions differed in each processing tub is supplied. While the bridge wall provided with the opening which lets a substrate pass is established between each above-mentioned processing tub and enabling conveyance of the substrate between processing tubs by the above-mentioned opening, the treating solution of the processing tub which adjoined with the bridge wall is kept from being mixed.

[0003]However, since the treating solution by the side of superior will have adhered to the substrate which shifted to the lower part side processing tub if the substrate to which the treating solution was supplied in the superior side processing tub is conveyed by the lower part side processing tub through an opening, In the lower part side processing tub, the treating solution by the side of superior and the treating solution by the side of the lower part are mutually mixed on a substrate, and the inconvenience that the description of the treating solution by the side of the lower part changes, and a substrate becomes poor processing arises. If the lower part side treating layer's treating solution mixes in a superior side treating solution when the drug solution is used especially for the superior side treating solution, a property variation will be large and treatment quality will deteriorate greatly.

[0004]While forming the air knife which countered the surface and rear surface of the substrate in the outlet part of a superior side processing tub as a substrate processing device with which the measure which avoids such inconvenience was adopted, The liquid end device forms the same air knife also as the inlet part of the lower part side processing tub, and kept the treating solution by the side of superior from shifting to the lower part side processing tub by the regurgitation of the gas to the substrate surface and rear surface from these air knives, A liquid end roller is formed so that the rear surface of a substrate may be crossed to the outlet part and inlet part of a processing tub by the side of superior and the lower part, and the liquid end device kept the treating solution by the side of superior and the lower part from being mixed with by the liquid end with this liquid end roller is known. What stops conveyance of a substrate when the treating solution supply by each processing tub is completed, makes a substrate incline, and was furthermore made to perform the liquid end in addition to these is known.

[0005]

[Problem(s) to be Solved by the Invention]By the way, the thing by which the air knife is formed in the inside of the both sides of the above-mentioned superior side processing tub and the lower part side processing tub, The distance

between air knives becomes large, and the amount of supply of air becomes superfluous easily. The substrate might dry, punctate or band-like nonuniformity might arise in the rear surface, the particle adhering to this nonuniformity adhered on the surface of the substrate by desiccation, and it had the problem that removal will be in a difficult state. Then, this regulation was dramatically difficult although what is necessary is just to have changed the substrate into the half-dry state.

[0006] If it is in some which form the above-mentioned liquid end roller, The floating matter in the air which adhered to the roller when the gap adjustment between liquid end rollers was difficult and the interval of a substrate and a roller was too narrow was transferred by the substrate face, and when the interval of a substrate and a roller was too large conversely, it had the problem that the liquid end of a substrate became insufficient.

[0007] If it is in some which make the above-mentioned substrate incline and were made to perform the liquid end, While the mechanism for making a substrate incline was needed all over the conveying path in a processing tub, the device became complicated and facility cost increased, the inclination of a substrate and restoration to the original horizontal position took time, and it had the problem that the processing efficiency of a substrate fell.

[0008] It is made in order that this invention may solve the above problems, It aims at providing the substrate processing device which can required and fully perform the liquid end in the state where a treating solution does not dry thoroughly that small and simple composition is also at the time of shift of the substrate from the superior side processing tub to the lower part side processing tub.

[0009]

[Means for Solving the Problem] A superior side processing tub which supplies a treating solution which the invention according to claim 1 is formed via a bridge wall provided with an opening which passes a substrate, and is different, respectively, and the lower part side processing tub, In a substrate processing device provided with a transportation means which conveys a substrate from a superior side processing tub to the lower part side processing tub through the above-mentioned opening, and a gas supply means which sprays a gas on a substrate that the liquid end of the treating solution should be carried out by the above-mentioned opening, The above-mentioned gas supply means is turned so that the superior [of a bridge wall] and lower part side may be attended at the above-mentioned opening, respectively, And it has a skillful side nozzle and a poor side nozzle which were provided so that the regurgitation of the

gas might be carried out toward a superior side discharge position and the lower part side discharge position to a substrate, Arrangement setting out of the above-mentioned skillful side nozzle and the poor side nozzle is carried out so that the above-mentioned superior side discharge position and the lower part side discharge position may be abbreviated-in agreement.

[0010]According to this invention, a treating solution is supplied to a substrate introduced into a superior side processing tub by transportation means by a horizontal position, After predetermined processing is performed with this treating solution, it is sent into the lower part side processing tub through an opening provided in a bridge wall, a treating solution of a kind different here from the above-mentioned superior side treating solution is supplied, and predetermined processing is performed with this treating solution.

[0011]And since a substrate faces passing an opening, a gas is breathed out toward the lower part side discharge position toward a superior side discharge position at a substrate from a poor side nozzle from a skillful side nozzle and both discharge positions are moreover set up it be abbreviated-in agreement, A gas which blew off from a skillful side nozzle in the upper part of a substrate located in an opening, An air current which went from a turbulence formation portion in a processing tub by the side of superior and the lower part generates a portion in which a gas which blew off from a poor side nozzle collided, a turbulent flow was formed in, and this turbulent flow was formed while it has high voltage rather than inside of a processing tub by the side of superior and the lower part.

[0012]And a treating solution which exists in a supply surface-ed [treating solution] of a substrate according to this air current is blown away, and a boundary region where a treating solution of a superior side processing tub and a treating solution of the lower part side processing tub are not mutually mixed with a substrate located in an opening by this is formed. A treating solution of a superior side processing tub which remained by existence of this boundary region to a substrate sent into the lower part side processing tub from a superior side processing tub is not mixed in the lower part side processing tub, and an adverse effect to substrate treatment by mixing of both treating solutions is avoided. Similarly the lower part side treating layer's treating solution does not mix in a superior side treating layer.

[0013]And in order that it may cross or a gas which blew off from a superior side gas exit cone, and a gas which blew off from the Shimoide side exit cone may collide each other

mutually on a supply surface-ed [treating solution] of a substrate, A width dimension of a substrate transportation direction of the above-mentioned boundary region is small as compared with a boundary region which was made to carry out the regurgitation of the gas in the direction mutually estranged from the conventional superior side and a poor side nozzle. Therefore, perfect desiccation of a supply surface-ed [treating solution] of a substrate in a boundary region can be controlled, and it becomes possible to control generating of nonuniformity by a substrate drying thoroughly certainly.

[0014]In the invention according to claim 1, the above-mentioned superior side discharge position and the lower part side discharge position of the according to claim 2 invention correspond on an effective area of the above-mentioned opening.

[0015]According to this invention, it becomes possible to make into the minimum a width dimension of a substrate transportation direction of a boundary region where a treating solution of a superior side processing tub on a substrate and a treating solution of the lower part side processing tub are not mixed mutually.

[0016]An angle at which the invention according to claim 3 faces the above-mentioned skillful side nozzle and a poor side nozzle the above-mentioned opening in the invention according to claim 1 or 2, respectively is set up identically.

[0017]According to this invention, it becomes possible to make the same specification of a skillful side nozzle and a poor side nozzle, and reduction of facility cost can be aimed at now.

[0018]

[Embodiment of the Invention]Drawing 1 is an explanatory view showing one embodiment of the substrate processing device 1 concerning this invention. It is installed side by side and the substrate processing device 1 is formed so that two or more processing tubs 11 may adjoin mutually. Each processing tub 11 has the substrate treatment chamber 12 of rectangular parallelepiped shape which processes the substrate B in the upper part. Each substrate treatment chamber 12 of each other is formed on both sides of the bridge wall 13, and the opening 14 which passes the substrate B is formed in this bridge wall 13. The substrate B is conveyed one by one toward the processing tub 11 of the right direction through these openings 14 from the processing tub 11 of the left of drawing 1. The earthenware mortar-shaped funnel parts 12a are formed in the lower part of the substrate treatment chamber 12, and the fluid collection of the treating solution supplied to the substrate B by this is made to be carried out.

[0019]In each processing tub 11, the roller (transportation means) 15 which has the axial center which intersected perpendicularly with the transportation direction of the substrate B is formed. These rollers 15 are set up and installed in the almost same height position as the above-mentioned opening 14 side by side in the substrate treatment chamber 12. The substrate B moves to the processing tub 11 by the side of the lower part from the processing tub 11 by the side of superior through the opening 14 by rotation of the roller 15 in the state where it was laid on these rollers 15. Hereafter, in drawing 1, the superior side processing tub 2 and the right-hand side processing tub 11 are called the lower part side processing tub 3 for the processing tub 11 on the left-hand side of a center portion.

[0020]The above-mentioned superior side processing tub 2 has the sprinkling tube 21 allocated above 15 rows of rollers in the substrate treatment chamber 12, and the superior side treating solution X is made to be supplied towards the surface of the substrate B on the roller 15 from this sprinkling tube 21. Besides, predetermined processing is performed to the surface of the substrate B by supply of the hand side treating solution X. The superior side treating solution X used for processing of the substrate B falls from the edge of the substrate B, and are collected on the **** tank 22 established in the lower part via the funnel parts 12a.

[0021]Between this **** tank 22 and the above-mentioned sprinkling tube 21, The superior side treating solution supply line 23 supplied to the sprinkling tube 21 is allocated, and the superior side treating solution X in the **** tank 22 in this superior side treating solution supply line 23. The treating solution feed pump 23a and the filter 23b are formed from the upstream, and the cyclic use of waste water of the superior side treating solution X in the **** tank 22 is carried out by the drive of the above-mentioned treating solution feed pump 23a.

[0022]The above-mentioned lower part side processing tub 3 has the sprinkling tube 31 allocated above 15 rows of rollers in the substrate treatment chamber 12. The lower part side treating solution Y is made to be supplied towards the surface of the substrate B on the roller 15 from this sprinkling tube 31. Predetermined processing is performed to the surface of the substrate B by supply of this lower part side treating solution Y. And the lower part side treating solution Y used for processing of the substrate B falls from the edge of the substrate B, and are collected on the **** tank 32 established in the lower part via the funnel parts 12a.

[0023]In this embodiment, predetermined drug solutions,

such as development for processing a substrate as the superior side treating solution X and etching exfoliation, are used, and wash water, such as a drug solution for washing for carrying out washing removal of the above-mentioned drug solution on a substrate and pure water, is used as the lower part side treating solution Y.

[0024]Between this ***** tank 32 and the above-mentioned sprinkling tube 31, The lower part side treating solution supply line 33 supplied to the sprinkling tube 31 is allocated, and the lower part side treating solution Y in the ***** tank 32 in this lower part side treating solution supply line 33. The treating solution feed pump 33a and the filter 33b are formed from the upstream, and the cyclic use of waste water of the lower part side treating solution Y in the ***** tank 32 is carried out by the drive of the above-mentioned treating solution feed pump 33a.

[0025]The gas supply means 4 for spraying a gas on the surface of the substrate B which passes the opening 14 near each above-mentioned processing tubs 2 and 3 is established. This gas supply means 4 is provided with the following.

The air knife part 40 (refer to [drawing 2](#)) attached to the bridge wall 13 of the upper limb of the above-mentioned opening 14.

The gas source 43 which supplies a gas to this air knife part 40 through the gas supplying pipe way 44.

[0026][drawing 2](#) shows one embodiment of the air knife part 40 provided in the opening 14 of the bridge wall 13 -- it is a notch perspective view in part, and [drawing 3](#) is a cross-sectional view of the air knife part 40. As shown in these figures, the air knife part 40 is provided with the superior side air knife 41 and the lower part side air knife 42, and is formed. The solid parts 41a and 42a which these air knives 41 and 42 covered the overall length of the longitudinal direction in the upper part, respectively, and were formed in inner substance, The nozzles 41c and 42c which have the gas exit cones 41d and 42d which were open for free passage to the air passages 41b and 42b formed so that it might extend in the lower part of these solid parts 41a and 42a horizontally, and these air passages 41b and 42b are provided.

[0027]Each above-mentioned air knives 41 and 42 are formed by the metal of the rectangular parallelepiped shape of predetermined thickness or the resin blocks (PVC etc.) which were set up so that a linear dimension might cross the substrate B under conveyance at least. the two forks which were projected toward the inside of the superior side processing tub 2 on the other hand to the lower edge section

of the bridge wall 13 formed in the upper part of the above-mentioned opening 14, and the lower part opened wide, while the superior side bracket 13a of ** is formed, the two forks which were projected toward the inside of the said lower part side processing tub, and the lower part opened wide -- the lower bracket 13b of ** is formed. And the solid parts 41a and 42a of each air knives 41 and 42 are inserted in each bracket 13a and 13b, and where a bolt stop is carried out, they are being fixed.

[0028]Where this air knife part 40 is fixed to the brackets 13a and 13b, The attaching position of the air knife part 40 is set up so that the crevice between some may be formed between 41d of the above-mentioned superior side gas exit cones and 42 d of the lower part side gas exit cones, and the substrate B that passes the lower part, and the substrate B does not come to interfere each other mutually with the air knife part 40 by this.

[0029]And where the air knife part 40 is fixed to the bridge wall 13, while 41 d of the above-mentioned superior side gas exit cones turn to the surface by the side of the lower part of the substrate B while passing the opening 14, Direction setting out of 42 d of the lower part side gas exit cones is carried out so that it may turn to the surface by the side of superior [of the substrate B], and from the superior side air knife 41, the gas supplied from the gas supply means 4 towards the said lower part side discharge position is breathed out from the lower part side air knife 42 in the superior side discharge position of the surface of the substrate B.

[0030]In this embodiment, as shown in drawing 3, the angle α formed between the nozzle center line S1 prolonged in the gas blow-off direction of the skillful side nozzle 41c, and the surface of the substrate B. It is set up smaller than the angle β formed between the nozzle center line S2 of the poor side nozzle 42c, and the surface of the substrate B (namely, $\alpha < \beta$), The thrust to the lower part side treating solution layer Y1 by the air current from the superior side air knife 41 by this, The lower part side treating solution Y1 is prevented from making it larger than the thrust to the superior side treating solution layer X1 by the air current from the lower part side air knife 42, especially entering in the superior side processing tub 2.

[0031]In this embodiment, so that the skillful side nozzle center line S1 and the poor side nozzle center line S2 may be the surfaces of the substrate B and it may cross mutually on the effective area of the opening 14, That is, the angle setting of each nozzles 41c and 42c is made so that a superior side discharge position and the lower part side discharge position may be in agreement on the effective area

of the opening 14, and the width dimension d of the boundary region R where each treating solution layer X1 and Y1 do not exist in the surface of the substrate B by this is made to become small.

[0032]On the other hand, near the substrate processing device 1, as shown in drawing 1 and drawing 2, the gas source 43 which supplies high pressure gas to the air knife part 40 is allocated. According to this embodiment, a high-pressure-nitrogen cylinder is applied and, as for the gas source 43, high pressure nitrogen gas is supplied to each air knives 41 and 42 from this cylinder. The gas supplying pipe way 44 was connected to the above-mentioned gas source 43, and, specifically, this gas supplying pipe way 44 has branched at the downstream end as the superior side branch pipe 44a and the lower part side branch pipe 44b.

[0033]And while the downstream end is connected to the superior side air knife 41 via the superior side opening and closing valve 45a, as for the superior side branch pipe 44a, as for the lower part side branch pipe 44b, the downstream end is connected to the lower part side air knife 42 via the lower part side opening and closing valve 45b. Therefore, it is possible by adjusting the opening of each opening and closing valves 45a and 45b to change the discharge quantity of the gas breathed out from each air knives 41 and 42.

[0034]In this embodiment, the opening of the superior side opening and closing valve 45a is made larger than the opening of the lower part side opening and closing valve 45b. He makes gas discharge quantity from the superior side air knife 41 larger than the gas discharge quantity from the lower part side air knife 42, and is trying to prevent certainly mixing into the superior side processing tub 2 of the lower part side treating solution Y by this. The adjustment supply of the high pressure gas from the gas source 43 is made to be carried out by performing this switching operation in the air passages 41b and 42b of each air knives 41 and 42 through the gas supplying pipe way 44.

[0035]According to the substrate processing device 1 of the above-mentioned composition, the substrate B conveyed by the lower part side processing tub 3 from the superior side processing tub 2 by the drive revolution of the roller 15.

While it faces passing the opening 14 of the bridge wall 13 and the upper face part receives injection of the gas from 41d of superior side gas exit cones of the air knife part 40, The turbulent flow region by the collision of the air current from each air knives 41 and 42 and the air current from 42d of the lower part side gas exit cones is formed in the surface of the substrate B directly under the bridge wall 13 of this in response to injection of the gas from 42d of the lower part side gas exit cones.

[0036]And since the superior side treating solution layer X1 formed in the surface of the substrate B pushes the surface of the substrate B on the upstream and will be in a ***** state according to the air current which goes to the upstream from the above-mentioned turbulent flow, the superior side treating solution layer X1 will be removed by the surface of the substrate B which passes the opening 14. The lower part side treating solution layer Y1 by the lower part side treating solution Y supplied to the surface of the substrate B from the liquid dispersion nozzle 31a is pressed by the air current which goes to the downstream from the above-mentioned turbulent flow, and it is prevented that the lower part side treating solution layer Y1 goes to the upstream. Therefore, the superior side treating solution X and the lower part side treating solution Y do not mix each other mutually on the substrate B.

[0037]And since the skillful side nozzle 41c and the poor side nozzle 42c incline so that those tips may approach mutually, the width dimension d of the boundary region R of the substrate B surface with the gas breathed out from each gas exit cones 41d and 42d becomes narrow, and the complete drying in this portion is prevented certainly. And it becomes possible by setting the crossing of the skillful side nozzle center line S1 and the poor side nozzle center line S2 as the surface of the substrate B to make the above-mentioned width dimension d into the minimum.

[0038]In order that drawing 4 may explain an operation of this invention, are the important section of drawing 1 the expanded partial expansion explanatory view, and (b), A state just before the substrate B reaches the opening 14, and (**), The substrate B passes the opening 14 and the state to which the downstream end (right direction) of the substrate B reached the opening 14, the state where, as for (**), the substrate B is passing the opening 14, and (**) show the state where the upstream end was conveyed by the downstream of the liquid dispersion nozzle 31a, respectively.

[0039]As first shown in (b) of drawing 4, just before the substrate B in the superior side processing tub 2 reaches the opening 14 of the bridge wall 13, the superior side treating solution layer X1 will be formed in the entire surface of the substrate B by supply of the superior side treating solution X from the sprinkling tube 21 of the superior side processing tub 2. Since the lower part side treating solution Y supplied from the sprinkling tube 31 of the lower part side processing tub 3 does not have the substrate B in the lower part, it will be flowed down as it is to the funnel parts 12a of the lower part side processing tub 3. The gas supplied from each gas exit cones 41d and 42d of the air knife part 40 will be

mutually crossed in the lower part, as an arrow shows.

[0040]Next, in the state which shows in (**) of drawing 4, the end of the downstream of the substrate B reaches the opening 14, and the opening 14 will be passed by the part. in this state, it point-becomes narrower on the surface of the substrate B, and the gas supplied from each air knives 41 and 42 of the air knife part 40 is come out of and supplied to it, and the superior side treating solution layer X1 currently formed in the surface of the substrate B of this is pushed on the upstream (left), and will be in a ***** state.

[0041]Next, in the state which shows in (**) of drawing 4, the downstream carries out equivalent length penetration at the lower part side processing tub 3, and the substrate B is in the state where the lower part side treating solution Y from the sprinkling tube 31 of the lower part side processing tub 3 is supplied to the surface of the substrate B. While the advance to the downstream of the superior side treating solution layer X1 is obstructed by the turbulence which blew off from each gas exit cones 41d and 42d, and was formed by crossing in this state, The penetration to the upstream of the lower part side treating solution Y is prevented by the air current of the gas which blew off from 42d of the lower part side gas exit cones, On the substrate [directly under] B of the air knife part 40, the band-like boundary region R (drawing 2, drawing 3) where the superior side treating solution X and the lower part side treating solution Y are not mixed mutually will be formed of this. The lower part side treating solution layer Y1 is formed in the downstream one by one from the sprinkling tube 31 of the substrate B in this state.

[0042]And in the state which shows in (**) of drawing 4, the upstream end of the substrate B passes the discharge flow bottom of the lower part side treating solution Y from the sprinkling tube 31 of the lower part side processing tub 3, and the lower part side treating solution layer Y1 will be formed in the entire surface of the substrate B of this.

[0043]As the substrate processing device 1 of this embodiment was explained in full detail above, the air knife part 40 is formed in the rising wall of the opening 14 drilled by the bridge wall 13 which divides the superior side processing tub 2 and the lower part side processing tub 3, in order to point-become narrower, to come out of a band-like air current and to make it spout from 41d of superior side gas exit cones, and 42d of the lower part side gas exit cones so that the substrate B conveyed by the opening 14 may be crossed, The substrate B faces passing the opening 14, On the substrate [directly under] B of the air knife part 40, the boundary region R where the superior side treating solution

X and the lower part side treating solution Y are not mixed mutually is formed of the air current which goes to the upstream and the downstream from 41d of the above-mentioned superior side gas exit cones, and 42d of the lower part side gas exit cones.

[0044]Therefore, while the superior side treating solution X and the lower part side treating solution Y are certainly prevented from facing passing the opening 14 of the bridge wall 13, and being mutually mixed on the surface of the substrate B, Since the width dimension d of the boundary region R (drawing 3) is very small compared with the former, While generating of the nonuniformity by the surface of the substrate B drying thoroughly until **** of the lower part side treating solution Y from the sprinkling tube 31 is performed on the surface of the substrate B is controlled certainly, the adherence to the substrate B surface of the floating mist by perfect desiccation is controlled certainly.

[0045]This invention is not limited to that of the above-mentioned embodiment, and a lower embodiment can also be used for it.

(1) Although the air knife part 40 is formed only in the rising wood of the opening 14 drilled by the bridge wall 13, it may be made to inject a gas also at the rear face of the substrate B in the above-mentioned embodiment with the air knife which was formed also in the margo-inferior part of the opening 14, and was formed in the margo-inferior part. Even if the superior side treating solution X has adhered to the rear face of the substrate B by carrying out like this, mixing of the lower part side treating solution Y to the superior side treating solution X is controlled certainly.

[0046](2) Although nitrogen is applied to the gas which blows off from the air knife part 40 in the above-mentioned embodiment, This invention is not limited to the gas which blows off from the air knife part 40 being nitrogen, air may be used for it depending on the kind of treating solution which processes the substrate B, and other inactive gas may be used for it. Reducing gas, such as hydrogen, may be used depending on the case.

[0047](3) Although each gas exit cones 41d and 42d of the air knife part 40 are formed in the above-mentioned embodiment of the slit shape opening prolonged in the direction (longitudinal direction) which intersected perpendicularly with the transportation direction of the substrate B, Many gas exit cones formed in spot form are installed in a longitudinal direction side by side, and it may be made to perform interval setting out between each gas exit cone instead of making each gas exit cones 41d and 42d into slit shape so that the regurgitation region in the

substrate B of the gas exit cone of each spot ** may overlap mutually.

[0048](4) Although the roller 15 which carries out a drive revolution as a transportation means which conveys the substrate B is used in the above-mentioned embodiment, a transportation means is not limited to the roller 15 and a conveyor belt may be used for this invention. In this case, the air knife part 40 is formed only in the upper surface side of the substrate B.

[0049](5) Although the cyclic use of waste water of the treating solutions X and Y supplied to the substrate B is made to be carried out in the above-mentioned embodiment, this invention is not limited to the cyclic use of waste water of the treating solutions X and Y being carried out, and it may be made to discharge it out of a system, after the substrate B is supplied.

[0050](6) Although the predetermined drug solution for processing a substrate as the superior side treating solution X is used and the wash water for carrying out washing removal of the above-mentioned drug solution on a substrate is used as the lower part side treating solution Y in the above-mentioned embodiment, This invention is not what is applied using a drug solution as the superior side treating solution X only when using wash water as the lower part side treating solution Y, Using wash water as the superior side treating solution X, also when using a drug solution as the lower part side treating solution Y, it can apply, and it may not be limited to one side of a treating solution being wash water further, and both sides may be a drug solution or a penetrant remover.

[0051](7) According to the above-mentioned embodiment, although the superior side discharge position of the substrate B surface in the opening 14 and the lower part side discharge position are coincided, it is not limited to both discharge positions of this invention corresponding, and the superior side discharge position and the lower part side discharge position may estrange or cross a little.

[0052](8) According to the above-mentioned embodiment, although it is made to differ from the angle of gradient alpha of the skillful side nozzle center line S1, and the angle of gradient beta of the poor side nozzle center line S2, both the nozzle center line S1 and the angles of gradient alpha and beta of S2 may be made the same. Since it becomes possible to make the superior side air knife 41 and the lower part side air knife 42 into the same specification by carrying out like this and it can share the air knives 41 and 42 by this, it becomes possible to reduce a manufacturing cost.

[0053]

[Effect of the Invention]According to the invention given

[above-mentioned] in Claim 1, a gas supply means, It is turned so that the superior [of a bridge wall] and lower part side may be attended at the above-mentioned opening, respectively, And it has the skillful side nozzle and poor side nozzle which were provided so that the regurgitation of the gas might be carried out toward a superior side discharge position and the lower part side discharge position to a substrate, Since arrangement setting out of the above-mentioned skillful side nozzle and the poor side nozzle is carried out so that a superior side discharge position and the lower part side discharge position may be abbreviated-in agreement, A substrate faces passing an opening and a gas is breathed out toward the lower part side discharge position toward a superior side discharge position at a substrate from a poor side nozzle from a skillful side nozzle. And the gas which blew off from the skillful side nozzle in the upper part of the substrate located in the opening, The air current which went from the turbulence formation portion in the processing tub by the side of superior and the lower part generates the portion in which the gas which blew off from the poor side nozzle collided, the turbulent flow was formed in, and this turbulent flow was formed while it has high voltage rather than the inside of the processing tub by the side of superior and the lower part.

[0054]And the treating solution which exists in the supply surface-ed [treating solution] of a substrate according to this air current is blown away, and the boundary region where the treating solution of a superior side processing tub and the treating solution of the lower part side processing tub are not mutually mixed with the substrate located in the opening by this is formed. Since it remains to the substrate sent into the lower part side processing tub from a superior side processing tub, and the treating solution of a superior side processing tub is not mixed in the lower part side processing tub by existence of this boundary region and that reverse can also be prevented, the adverse effect to the substrate treatment by mixing of both treating solutions is avoided.

[0055]And in order that it may cross or the gas which blew off from the superior side gas exit cone, and the gas which blew off from the Shimoide side exit cone may collide each other mutually on the supply surface-ed [treating solution] of a substrate, The width dimension of the substrate transportation direction of the above-mentioned boundary region is small as compared with the boundary region which was made to carry out the regurgitation of the gas in the direction mutually estranged from the conventional superior side and a poor side nozzle. Therefore, perfect desiccation of the supply surface-ed [treating solution] of the substrate

in a boundary region can be controlled, it becomes possible to control generating of the nonuniformity by a substrate drying thoroughly certainly, and the adherence to the substrate face of the floating mist by perfect desiccation is controlled certainly.

[0056]According to the invention given [above-mentioned] in Claim 2, since the superior side discharge position and the lower part side discharge position are in agreement on the effective area of an opening, it becomes possible to make the width dimension of the substrate transportation direction of the above-mentioned boundary region into the minimum.

[0057]According to the invention given [above-mentioned] in Claim 3, a skillful side nozzle and a poor side nozzle, Since the angle which attends the above-mentioned opening, respectively is set up identically, it becomes possible to make the same specification of a skillful side nozzle and a poor side nozzle and the common use of a nozzle of it is attained, it becomes possible to aim at reduction of facility cost.

[Translation done.]